Test Methods for the Determination of Anisotropic Compliances in 3D Woven Preforms for Ablative TPS, Phase I

Completed Technology Project (2013 - 2013)

Project Introduction

Based on the recent success of the Mars Exploration Program and the Mars Science Laboratory mission, NASA has a desire to expand on the technology developed under each effort in order to increase future mission capabilities, namely an increase in payload capacity for entry to Mars, Venus and other Outer-Planets. Such a goal requires an innovative solution to the vehicle's entry, decent and landing system (EDL). In order to address this goal,NASA has recently invested in the development of low ballistic coefficient aeroshell technology concepts which typically consist of a flexible 3D woven carbon cloth that can be stowed during flight and deployed to serve as a semi-rigid aeroshell on atmospheric entry. The ability of individual groups of fibers within yarn bundles to undulate in multiple orientations relative to the major axis of the yarn bundle results in full anisotropy for the 3D woven preforms. In addition to adding more complexity to the accompanying analytical models, the testing of such materials is also complicated as compared to isotropic and transversely orthotropic materials. Within the proposed Phase I effort, Materials Research & Design will develop test methods for the materials characterization of a hybrid, woven 3D fabric for use in a flexible TPS application. The program willinvolve analytical, fabrication and experimental tasks to achieve the overall program goal of maturing technologies for advanced EDL systems. A few select tests will be performed at Southern Research Institute with strain data being captured for use in the anisotropic compliance matrix calculations. Finite element simulations, using a homogeneous representation of the anisotropic material, will be used to simulate each test and aide in the design of test specimens sufficient to generate measurable strain levels while simultaneously allowing the anisotropic material to deform naturally.

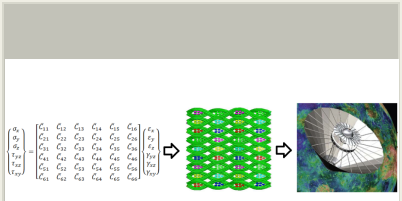

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Table of Contents

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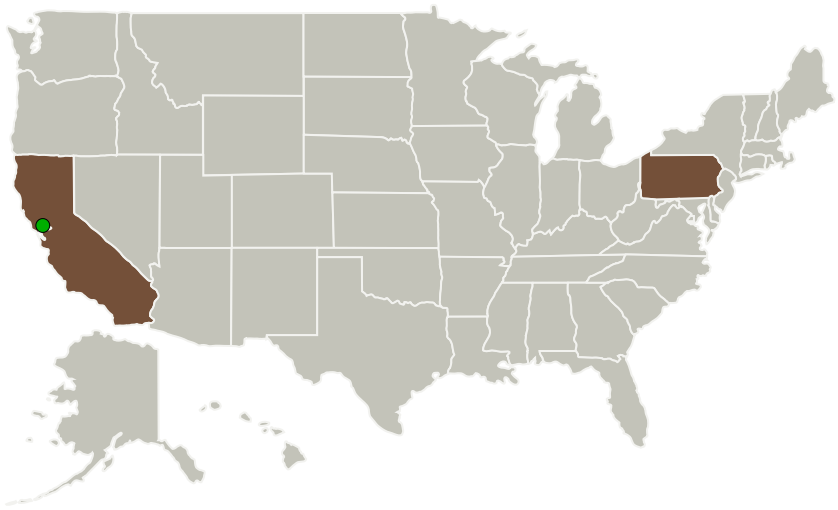
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Materials Research and Design, Inc.	Lead Organization	Industry	Wayne, Pennsylvania
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	Pennsylvania

Project Transitions

May 2013: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Materials Research and Design, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Craig Iwano

Co-Investigator:

Craig Iwano

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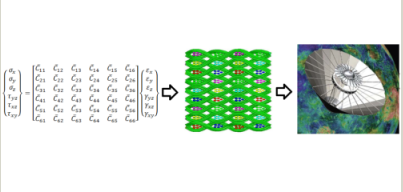
November 2013: Closed out

Closeout Summary: The next technology maturation step for Solstar is to deve lop the next generation space communicator payload to include advancements l earned from the flights provided under this agreement.

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137352)*

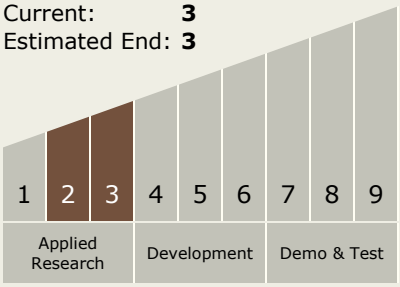
Images



Project Image
Test Methods for the Determination of Anisotropic Compliances in 3D Woven Preforms for Ablative TPS *(https://techport.nasa.gov/image/132164)*

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
  - TX09.1 Aeroassist and Atmospheric Entry
    - TX09.1.1 Thermal Protection Systems

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System